



Improving Individual and Team Decisions Using Iconic Abstractions of Subjective Knowledge

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Background:

- Research has shown that in a group decision making environment, members usually discount any uniquely held information that gets shared with the group.*
- This shared, uniquely held information typically does **not** significantly impact the final decision.
 - “You can lead a group to information, but you can’t make it think.”**
- **Why is this true?**

*Stasser et al, 85, 96, 98

**Dennis, 1996



Hypothesis

- (1) A group member already has a high cognitive burden in processing the information he has found.
- (2) Shared information from other members usually arrives in an unprocessed form:
 - “Here’s a relevant report you should read”
- (3) The new information is not integrated into the decision process because it causes too great of a cognitive burden on the recipient.



Approach

- Exchange processed, subjective assessment information:
 - “Read this report” vs.
 - “Read this report if you wish. I found that this report has high credibility, the information is timely, backed up by facts, is of high importance and has a strong negative effect on use of option C. ”
 - **How do we encapsulate/display these subjective assessments?**

Information Object (IOB)

An IOB is an iconic encapsulation of the subjective assessments an individual has assigned to a particular information item.

It is automatically created from an abstraction template.

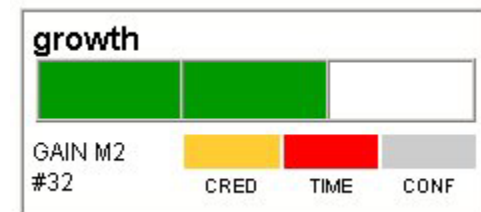
It is analogous to military tactical symbology.



Original document



IOB Representation of subjective assessments



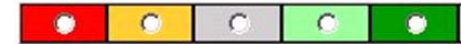
IOBs Convert IMPLICIT subjective estimates into EXPLICIT estimates.



Credibility?



Effect/Impact?



Importance?



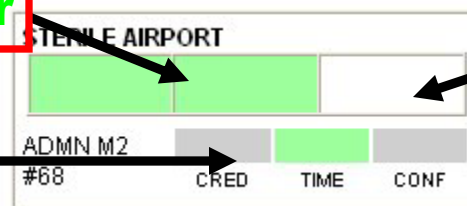
Timeliness?



Encapsulate the scores into an IOB that displays information quality, impact and importance

Effect/Impact: **Color**

Quality of information



Information **Importance:**
Size of color bar (1, 2 or 3 sections filled)

IOB

IOB creation process



Step 1: Select document for retention

Title:

Criterion: ☐ HIST ☐ ADMN ☐ GAIN ☐ PROB

V.Low/Poor Avg. V.High/Good

Credibility: ☐ ☐ ☐ ☐ ☐ ? ☐ ?

Step 2: Activate Abstraction Template

Title:

Criterion: ☐ HIST ☐ ADMN ☒ GAIN ☐ PROB

V.Low/Poor Avg. V.High/Good

Credibility: ☐ ☒ ☐ ☐ ☐ ? ☐ ?

Timeliness: ☐ ☒ ☐ ☐ ☐ ? ☐ ?

Confidence: ☐ ☒ ☐ ☐ ☐ ? ☐ ?

V.Neg. Neutral V.Pos.

Effect: ☐ ☒ ☐ ☐ ☐ ? ☐ ?

Importance: ☐ ☒ ☐ ☐ ? ☐ ?

Discard (1)Avg. (2)High (3)V.High

Step 3: Complete Assessment

Software creates and stores an **Information Object (IOB) in designated database**

growth

GAIN M2 #32

CRED TIME CONF

The decision environment:

Vulnerabilities and Potential Improvements for the Air Cargo Security Gets Another 'F'

What GAO Found

Numerous government and industry studies have identified vulnerabilities in the air cargo system. These vulnerabilities occur in the security of cargo at various points and include weaknesses and in possible steps taken at various checkpoints that occur from the point where cargo ships to the point where it is loaded onto an aircraft. As a result, weaknesses in this program could create security risks.

FAA or the U.S. airport security under fire

responsibility for security since 9/11.

On 9/11, the FAA was responsible for security since 9/11.

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Take action A?

Take action A?

Documents

vs

IOBs

[illegible]

Member already has a high cognitive burden. What is the likelihood these will be integrated into his decision process?

Administration

Overall Criterion Score:

| Industry Projects Index | | | | TPS Reports | | | | Red Tape | | | | LMT | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| <div style="display: flex; justify-content: space-between;"> <div>ADMN M2 #17</div> <div style="width: 100%; height: 20px; background-color: orange;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | | <div style="display: flex; justify-content: space-between;"> <div>ADMN M2 #1</div> <div style="width: 100%; height: 20px; background-color: red;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | | <div style="display: flex; justify-content: space-between;"> <div>ADMN M2 #13</div> <div style="width: 100%; height: 20px; background-color: orange;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | | <div style="display: flex; justify-content: space-between;"> <div>ADMN M2 #18</div> <div style="width: 100%; height: 20px; background-color: lightgreen;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | |

| consent agree | | | | Memo 1 | | | |
|--|--|--|--|---|--|--|--|
| <div style="display: flex; justify-content: space-between;"> <div>ADMN M2 #29</div> <div style="width: 100%; height: 20px; background-color: orange;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | | <div style="display: flex; justify-content: space-between;"> <div>ADMN M2 #2</div> <div style="width: 100%; height: 20px; background-color: orange;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | |

“Here’s more...”

| Domestic Shipping | | | |
|---|--|--|--|
| <div style="display: flex; justify-content: space-between;"> <div>HIST M1 #26</div> <div style="width: 100%; height: 20px; background-color: green;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | |

| Globalization | | | |
|---|--|--|--|
| <div style="display: flex; justify-content: space-between;"> <div>HIST M4 #37</div> <div style="width: 100%; height: 20px; background-color: red;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> CRED TIME CONF </div> | | | |

“Here’s more...”



Research Question:

- IOBs may be a convenient way of exchanging subjective assessments about an information item, but.....

Does the use of IOBs improve decision making performance?



PG School Experiment

18 Officers



- Display: Text vs. IOBs
- Decision: Positive* vs. Negative*

| | | Display | | |
|----------|----------|-----------|------|------------|
| | | Text Only | IOBs | |
| Decision | Positive | N=5 | N=5 | N=10 |
| | Negative | N=4 | N=4 | N=8 |
| | | N=9 | N=9 | N (tot)=18 |

*Positive = Yes, use Islandia Negative = No, don't use Islandia



Task:



- Volcanic disaster in the Pacific
- Should we recommend Islandia as the refugee site?
 - Sees 30 information items (randomized)
 - 5 decision criteria
 - 6 items per criteria



The Five Decision Criteria

[**COM**munications - **TSP**ortation - **LAB**or - **ADM**istration - **SAN**itation]

- **Communications Facilities (COM):** Assess the communication facilities that are available in Islandia, including land telephone systems, radio, TV, cellular phone availability and coverage, etc.
- **Transportation Facilities (TSP):** Assess the transportation facilities that are available in Islandia, including roads, docks, airports, etc.
- **Labor Pool (LAB):** Assess the labor pool that would be available to staff the camp in Islandia, including size of the pool, quality of workers, work ethic/tradition, etc.
- **Administrative Requirements (ADM):** Assess the administrative requirements needed to set up the camp in Islandia, including, permits, fees, environmental considerations, bureaucratic red tape, graft, bribes, etc.
- **Sanitation/Health/Medical conditions (SAN):** Assess the sanitation, health and medical conditions expected in Islandia, including drinking water, sewerage disposal, medical facilities, infectious diseases, etc.



Decision Tasks:

A screenshot of a web-based decision task interface. It features a grid of five criteria (COM, TSP, LAB, ADM, SAN) each with five colored buttons (red, yellow, grey, green, dark green) representing a scale from 'Very Neg.' to 'Very Pos.'. Below the grid is an 'Overall Recommendation' section with the same five buttons. At the bottom are 'Submit' and 'Reset' buttons.

| | Very Neg. | | | | Very Pos. |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| COM: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| TSP: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| LAB: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| ADM: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| SAN: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Overall Recommendation: | | | | | |
| | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="button" value="Submit"/> <input type="button" value="Reset"/> | | | | | |

5 Criteria Decisions,

1 Overall Decision

Text Condition (9 subjects)

1/30

....A cultural tradition in Islandia is that each worker is given a single two month vacation each year, which he can take any time during the year. All the employee has to do is give the employer a one week notice before going on vacation. This has caused unexpected and disrupted work shortages when several employees elect to take the vacation at the same time....

Criterion:

| | | | | |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| COM <input type="radio"/> | TSP <input type="radio"/> | LAB <input type="radio"/> | ADM <input type="radio"/> | SAN <input type="radio"/> |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|

Submit >

[**COM**munications - **TSP**ortation - **LAB**or - **ADM**istration - **SAN**itation]

- **Communications Facilities (COM):** Assess the communication facilities that are available in Islandia, including land telephone systems, radio, TV, cellular phone availability and coverage, etc.
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- **Sanitation/Health/Medical conditions (SAN):** Assess the sanitation, health and medical conditions expected in Islandia, including drinking water, sewerage disposal, medical facilities, infectious diseases, etc.

Read this, then assign it to one of the five criteria

(do 30 of these)

IOB Condition (9 subjects)

1/30

The environmental protection effort in Islandia is poorly organized and has had little effect. Environmental impact is not a consideration in any awarding of construction permits.

Read this, then:

| | | | | |
|------------|------------------------------------|-------------------------------|-------------------------------|------------------------------------|
| Title: | <input type="text"/> | | | |
| Criterion: | COM <input type="radio"/> | TSP <input type="radio"/> | LAB <input type="radio"/> | SAN <input type="radio"/> |
| Effect: | Very Neg. <input type="radio"/> | Neg. <input type="radio"/> | Pos. <input type="radio"/> | Very Pos. <input type="radio"/> |
| Submit > | | | | |

Assign a keyword

Assign it to a criterion

Evaluate its effect on the criterion

[**COM**munications - **TSP**ortation - **LAB**or - **ADM**istration - **SAN**itation]

- **Communications Facilities (COM):** Assess the communication facilities that are available in Islandia, including land telephone systems, radio, TV, cellular phone availability and coverage, etc.
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(This experiment uses only the subjective assessment of **EFFECT**, does not tap Importance, Credibility, etc.)

IOBs Explained

INSTRUCTIONS

You have now evaluated all 30 items. Your last task is to assign rating scores to each criterion, as well as one final overall rating. Your previous scoring of the items has been used to create an "Information Object" (IOB) for each information item.

This IOB includes the information you previously assigned, i.e. the key words, the criterion and the rating. The key words are hyperlinked to the original text item so that you can call it up for review by simply clicking on the key words. When you do this, the text will appear in a window to the right of the display. The effect you selected for each item is represented by the color bar in the IOB. A sample IOB is presented below:



Your Keyword

Your criterion Assignment

Your assessment of the Effect
on selecting Islandia

The IOB items are available to you for review using a drop-down sorting menu that can present all the IOBs associated with all the criterion or you can elect to see only the IOBs associated with one individual criterion.



How to sort your data

Decision Display: IOB

View:

Communications

| | | |
|----------------------------------|----------------------------------|--------------------------------|
| 104: 77 COM | 109: 99 COM | 95: 666 COM |
| 114: 567 COM | 121: rttt COM | 99: 11 COM |
| 120: ertt COM | | |

Transportation

| | | |
|----------------------------------|----------------------------------|--------------------------------|
| 100: 22 TSP | 105: 775 TSP | 96: 777 TSP |
| 94: ports TSP | 93: 666 TSP | 92: 66 TSP |
| 112: 777 TSP | 118: dfgg TSP | |

Very Neg. Very Pos.

| | | | | | |
|-------------------------|---------------------------------------|--------------------------------------|--|--|--|
| COM: | | | | | |
| TSP: | | | | | |
| LAB: | | | | | |
| ADM: | | | | | |
| SAN: | | | | | |
| Overall Recommendation: | | | | | |
| | <input type="button" value="Submit"/> | <input type="button" value="Reset"/> | | | |

Click on the hyperlinked titles in the IOB to display the original text here.

Hyperlinked

Decision Display: Text

View: All Go

Communications

The environmental protection effort in Islandia is poorly organized has has little effect. Environmental impact is not a consideration is any awarding of construction permits.

A recent disaster simulation exercise in Islandia showed that the Emergency Medical were very inadequate in terms of handling anything other than the smallest disaster situation.

* The major ports of Islandia are less than three days sailing from the primary disaster recovery supply center at Naha. Naha also has three supply ships that are permanently loaded to be used in quick response assistance....*

Every small town in Islandia has at least one phone

*The major air route to Islandia is from Chenche. That route, however, requires that we fly over the nation of Gambist, and Gambist has denied permission to fly over their airspace. The two options are to modify the flight plan or to use another departure airport. Both of these options results in excessively long flights, limits cargo capacity, and reduces the daily amount of supplies that can be transported to Islandia....*

Very Neg.

Very Pos.

COM: 1 2 3 4 5

TSP: 1 2 3 4 5

LAB: 1 2 3 4 5

ADM: 1 2 3 4 5

SAN: 1 2 3 4 5

Overall Recommendation: 1 2 3 4 5

Submit Reset

The items the subject assigned to the Communications criterion



IOB Subjective Assessment

One Last Request: Please select one of the options below in terms of how useful the IOBs were in making your scoring decision (this would be as versus just seeing the text listing of the items you assigned to each criterion)

| | | | |
|-------------------------|-----------------------|-----------------------|---------------------------------------|
| Somewhat distracting | No Effect | Helped Somewhat | Helped a lot |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | | | <input type="button" value="Submit"/> |



Positive vs Negative

**1/2 of Subjects should make
a decision that is **Positive**:**

3 of 5 criteria are Positive

**1/2 of Subjects should make
a decision that is **Negative**:**

3 of 5 criteria are Negative

Positive Criterion: 4 of the 6 statements are positive

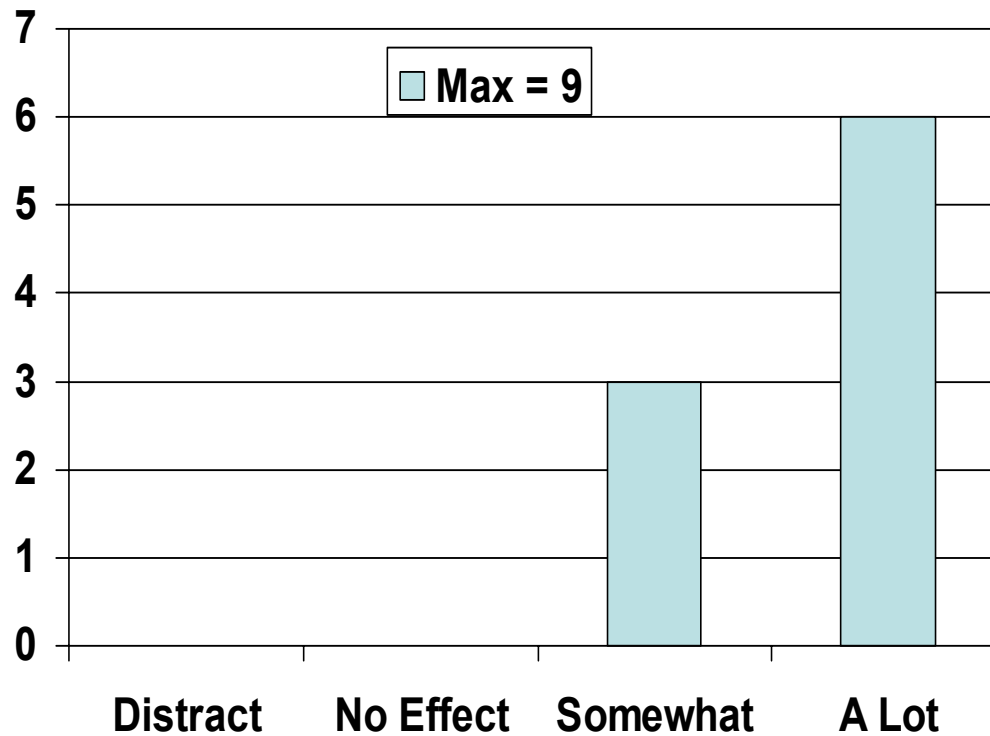
Negative Criterion: 4 of the 6 statements are negative



RESULTS

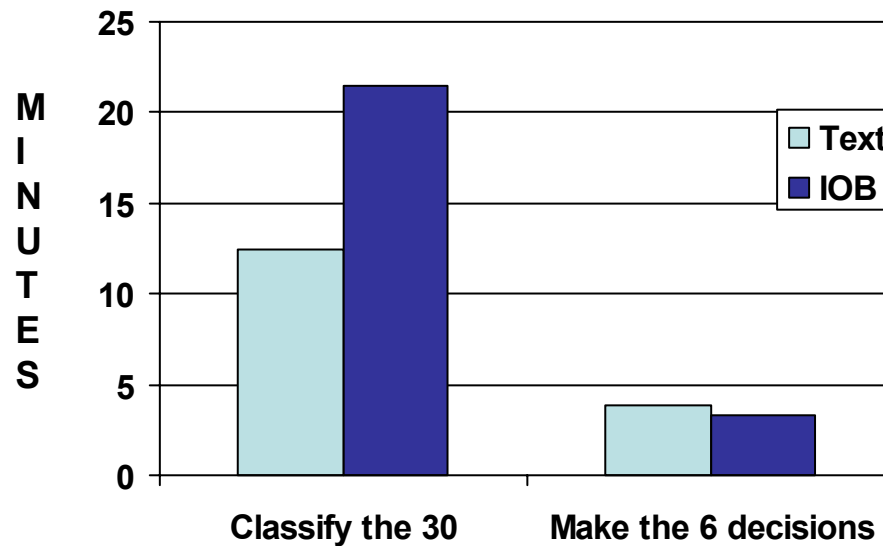


Subjective Assessment



IOBs HELP?

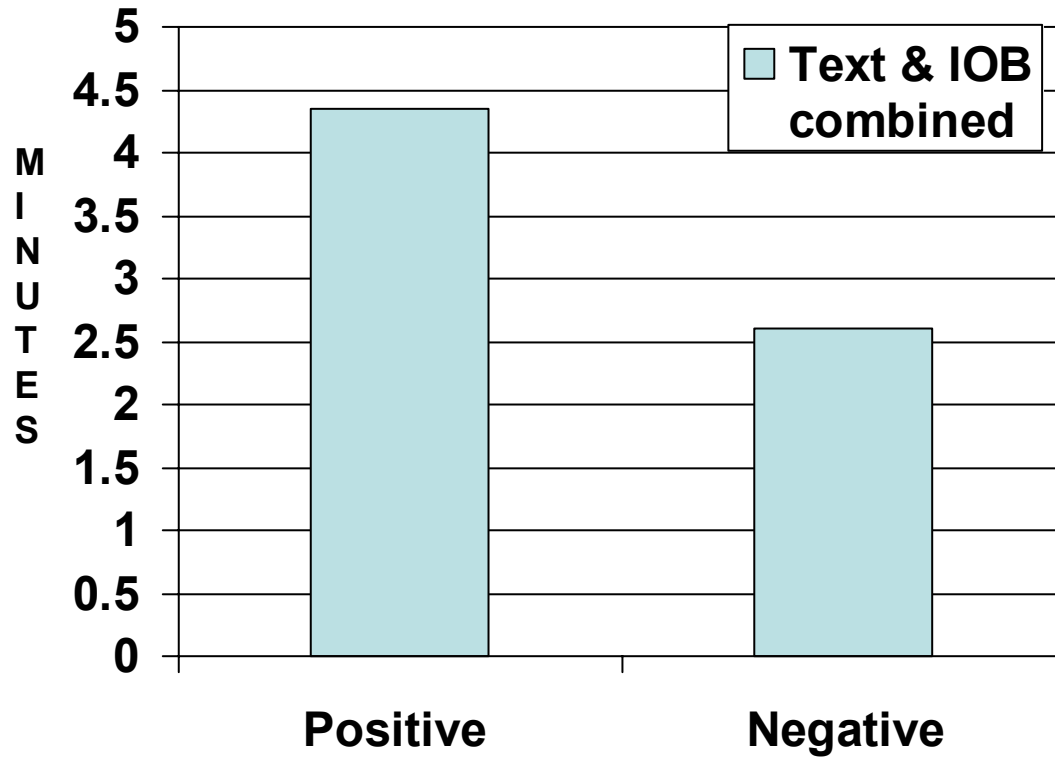
Time Factor



IOB subjects took an average 18 seconds longer per item to enter keyword and make evaluation



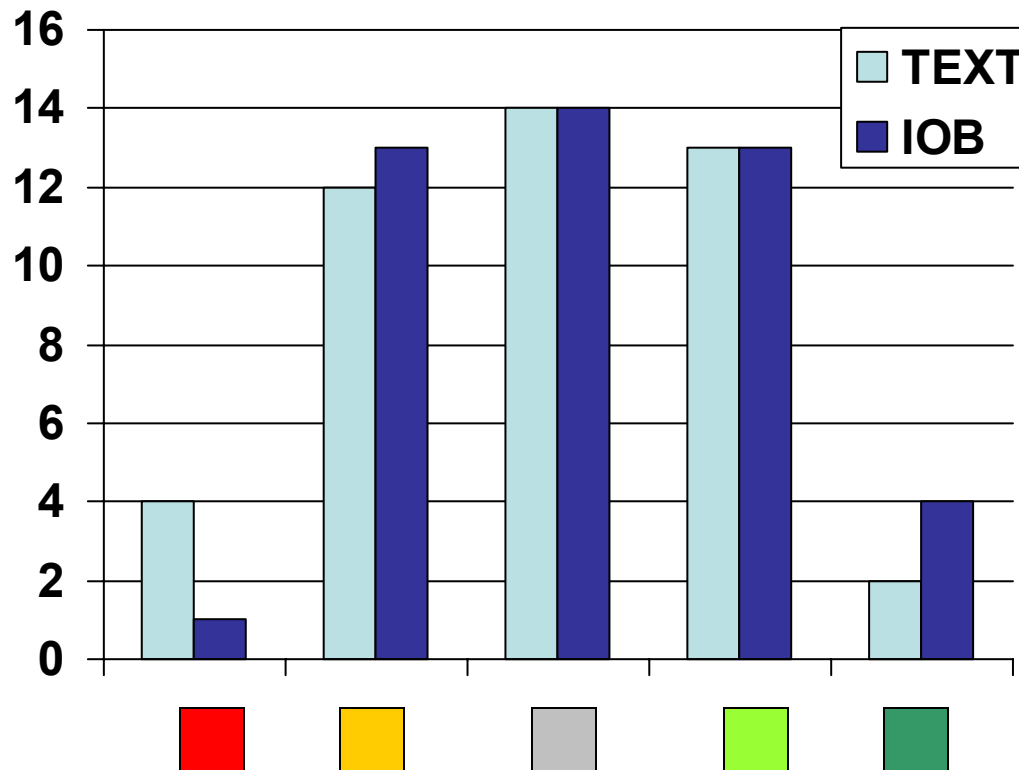
TIME TO MAKE DECISIONS



Significant Difference



Score Assignment to Criteria



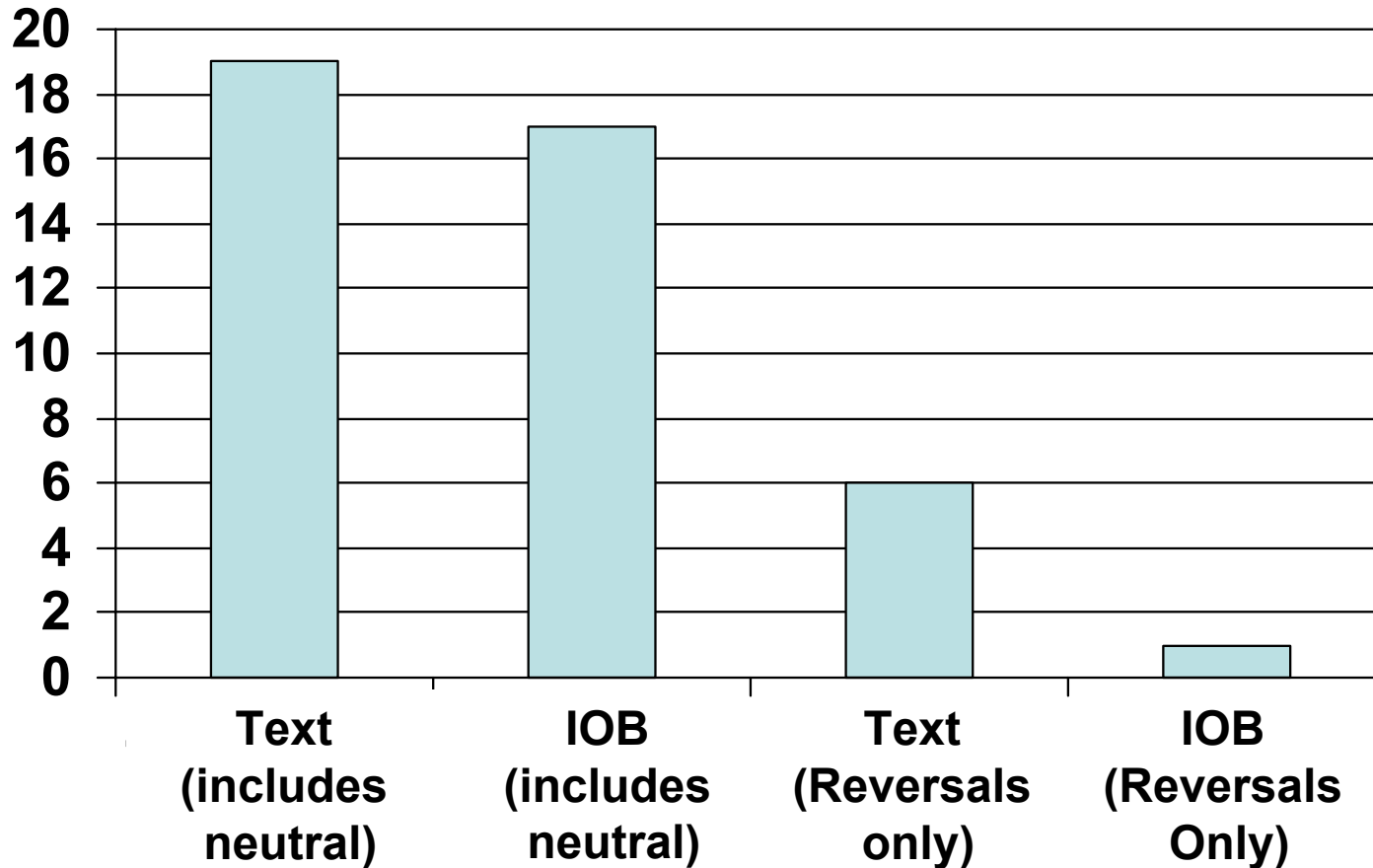


Errors:

- All criteria should have been scored as either positive or negative
 - Assignment of a neutral rating is scored as an error
 - For the IOB subjects, whether the correct decision was Positive or Negative was based on the subject's ratings
 - For the Text subjects, correct decision was based on experimenter's classification
 - Reversal Error (most serious): Positive group of information given a Negative rank (or vice versa)

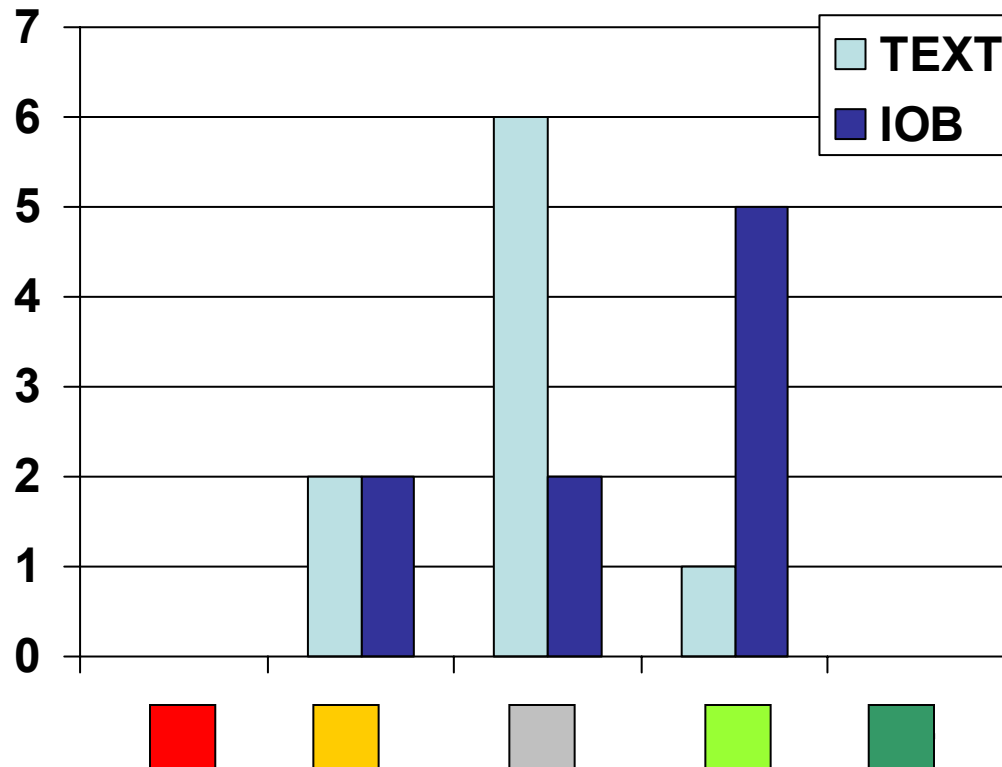


Errors in Criterion Scoring



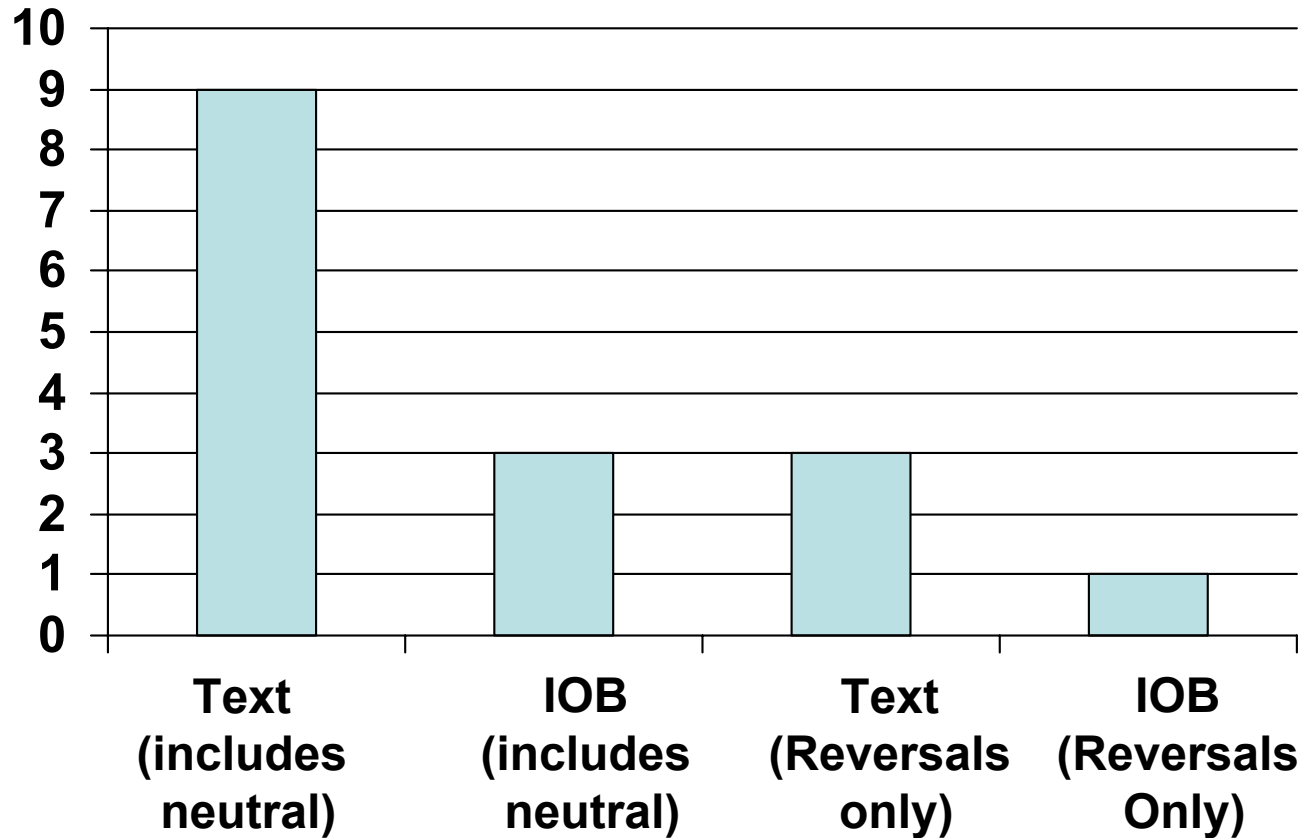


Score Assignment to Overall

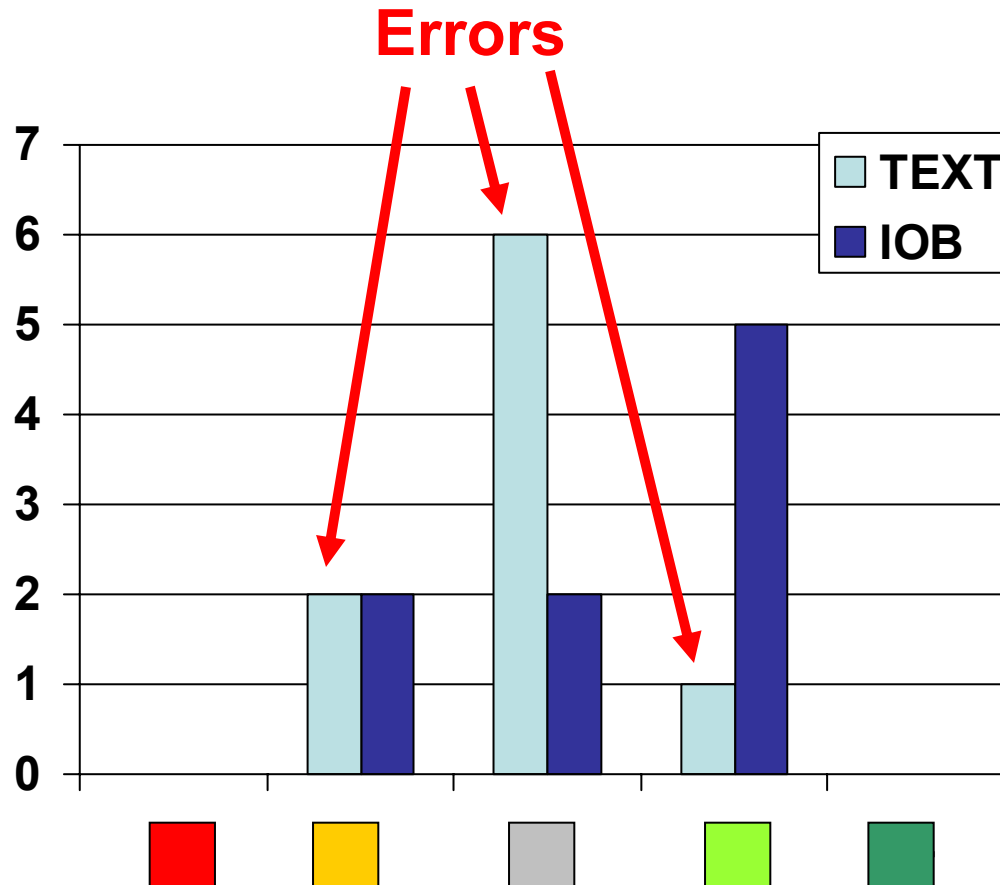




ERRORS OVERALL



Score Assignment to Overall

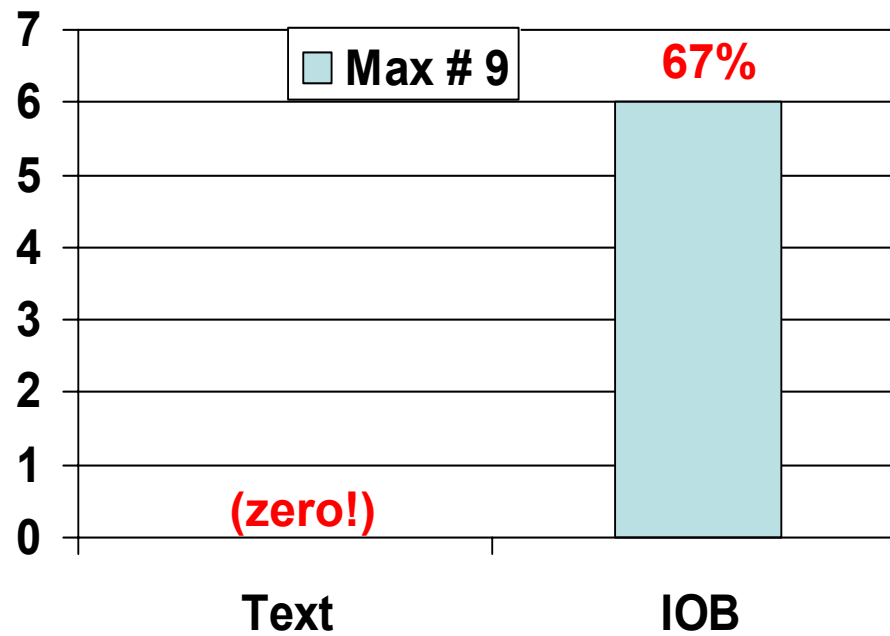




Bottom Line:



Correct Overall Decision





Summary

- No members of the Text group made a correct Overall decision:
 - Preferred the neutral rating
- Six of the nine IOB group made a correct Overall decision
- Subjects took longer to make a decision when preponderance of data was Positive
- IOB subjects gave favorable ratings to use of IOBs in decision making

Preliminary Follow-up Data

- 36 Subjects at Colorado State
- Rank Order 3 companies in terms of a good stock investment
 - Standardized test used in other studies
- Compare decision performance of subjects who used IOB subjective assessment color bar (Effect and Importance) vs. those that did not.



Used Subjective
assessment

Did not use
Subjective
assessment



Use of Subjective Assessments

